A.D. 1866, *8th September.* N° 2306.

Water-power Engines.

LETTERS PATENT to Edward Thomas Hughes, of the Firm of Hughes and Son, Patent Agents, 123, Chancery Lane, London, for the Invention of "IMPROVEMENTS IN WATER-POWER ENGINES."—A communication from abroad by William Lonsdale and William Peete, of New York, United States of America.

Sealed the 1st March 1867, and dated the 8th September 1866.

PROVISIONAL SPECIFICATION left by the said Edward Thomas Hughes at the Office of the Commissioners of Patents, with his Petition, on the 8th September 1866.

I, EDWARD THOMAS HUGHES, of the Firm of Hughes and Son, Patent Agents, 123, Chancery Lane, London, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN WATER-POWER ENGINES," a communication to me from abroad by William Lonsdale and William Peete, of New York, United States of America, to be as follows :—

I use a rotary valve having a partition which commands the ports which lead to each end of the cylinder and connects them alternately with the feed pipe and the exhaust, the said partition being placed a suitable distance from the axis of the valve, so as to permit the introduction or use of chambers, constructed as herein-after described, for the purpose of counteracting a portion of the pressure of the water from the feed pipe on the said partition, whereby the friction of the ends of the said partition on the valve seat is greatly reduced and the valve is much more easily operated.

I also construct the said partition of such shape and dimensions in relation to the said ports that in the act of reversing the valve there is a perceptible interval at the end of each stroke, when the pressure in the cylinder is partly relieved, and the water is allowed to pass around the ends of the said partition from the feed pipe to the exhaust, whereby I am enabled to prevent a shock in stopping the piston at the end of the stroke and starting it in the opposite direction.

I also use, in combination with the said partition constructed as described, an improved cam motion for operating the said valve, in which the cam is of equal diameter in all directions, measuring through the centre of motion, and is set in a suitable yoke provided with friction rollers on the end of the cam rod, and connected with the said valve by suitable connections, whereby the said cam rod, and consequently the said valve, are held firmly or moved steadily through all portions of the revolution of the said cam, and the said valve is prevented from "chattering."

In the accompanying Drawings Fig. 1 is a side elevation of a water engine constructed according to my Invention; Fig. 2 is a vertical axial section of the cylinder, valve, and ports; Fig. 3 is a vertical cross section of the cylinder, valve, &c.; Figures 4 and 5 show the valve gear and connections, a portion of the rod M being broken away to save space in the Drawing.

A is the cylinder; B, the piston; D and E, the ports; and F, the valve; C is the feed pipe, through which the water from the reservoir having a suitable head or fall is fed into the valve F; G is the partition which controls the direction in which the water passes after it enters the valve F. When the partition is set, as seen in Figure 2, the water passes from the valve chamber F into the port D, and through the said port to the cylinder A to the left of the piston forcing it to the right. The water which had previously forced the piston B to the left escapes through the port E into the exhaust pipe I. When the piston has arrived nearly to the end of the stroke the cam J, Figure 5, begins to reverse the valve, and when the piston has gone quite to the end of the stroke the partition G is then in the middle of the ports E and D, and as the water from both ends of the cylinder can escape at the exact instant at which the change in the motion of the piston takes place, the feed pipe cylinder and connections are relieved from the danger of any shock. The time during which the water can thus escape is so short that a slow motion imparts sufficient force to the engine to carry it past the centres, and there is no greater liability to stop on the centre than in the ordinary steam engine. The cam J, as to its form, consists of two concentric portions situated opposite each other, each of which is equal to one-third of a circle, and two curved

portions having the outline of an ogee which connect these circular portions; these curved portions serve to give motion to the valve while the circular portions provide for holding it perfectly still through two-thirds of the revolution of the shaft K, thereby preventing the chattering of the valve when it should be at rest; the cam J and connections are clearly shown in Figures 4 and 5, in which L is the yoke on the rod M; N, N, are friction rollers; O is an intermediate arm or lever for adjusting the amount of motion to be given to the arm P of the valve; this is done by moving the pin Q up or down. The valve F consists of two circular heads S, S, with a partition G supported between them; this partition G is set below or to one side of the centre, and the ports D and E open into the valve chamber in a corresponding position to give room on the opposite side of the interior surface of the valve chamber for a bearing for the chambers R, R, which may be cast in one piece with the partition G and heads S, S, of the valve F. At their junction with the interior surface of the valve chamber they form a water-tight joint, and the interior C communicates through suitable openings with the outside of the valve chamber, so that the interior C of the said chamber R is entirely relieved from pressure, and consequently by the pressure exerted by the water on the concave surface of the said chambers R, R, which is inside the valve chamber tends to counteract the pressure in the opposite or nearly opposite direction on the partition G, and thus reduce the friction of the partition G on the valve seat. To provide against leakage by the wearing of the valve in its seat or chamber they may be made tapering, so that the said valve may be set further in as it wears, thus keeping it tight.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Edward Thomas Hughes in the Great Seal Patent Office on the 6th March 1867.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Edward Thomas Hughes, of the Firm of Hughes and Son, Patent Agents, 123, Chancery Lane, London, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Eighth day of September, in the year of our Lord One thousand eight hundred and sixty-six, in the thirtieth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Edward Thomas Hughes, Her special licence that I, the said Edward Thomas Hughes, my executors, administrators, and assigns, or such others

as I, the said Edward Thomas Hughes, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN WATER-POWER ENGINES," a communication to me from abroad by William Lonsdale and William Peete, of New York, United States of America, upon the condition (amongst others) that I, the said Edward Thomas Hughes, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Edward Thomas Hughes, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement (that is to say):—

I use a rotary valve having a partition which commands the ports which lead to each end of the cylinder and connects them alternately with the feed pipe and the exhaust, said partition being placed a suitable distance from the axis of the valve, so as to permit the introduction or use of chambers constructed, as herein-after described, for the purpose of counteracting a portion of the pressure of the water from the feed pipe on the said partition, whereby the friction of the ends of the said partition on the valve seat is greatly reduced, and the valve is much more easily operated.

I also construct the said partition of such shape and dimensions in relation to the said ports, that in the act of reversing the valve there is a perceptible interval at the end of each stroke when the pressure in the cylinder is partly relieved, and the water is allowed to pass around the ends of the said partition from the feed pipe to the exhaust, whereby I am enabled to prevent a shock in stopping the piston at the end of the stroke and starting it in the opposite direction.

I also use in combination with the said partition, constructed as described, an improved cam motion for operating the said valve in which the cam is of equal diameter in all directions, measuring through the centre of motion, and is set in a suitable yoke provided with friction rollers on the end of the cam rod and connected with the said valve by suitable connections, whereby the said cam rod, and consequently the said valve, are held firmly or moved steadily

through all portions of the revolution of the said cam, and the said valve is prevented from "chattering."

In the accompanying Drawings, Fig. 1 is a side elevation of a "water engine" constructed according to this Invention; Fig. 2 is a vertical axial section of the cylinder valve and ports; Fig. 3 is a vertical cross section of the cylinder valve, &c.; Figs. 4 and 5 shew the valve gear and connections, a portion of the rod M being broken away to save space in the Drawing.

A is the cylinder; B, the piston; D and E, the ports; and F, the valve; C is the feed pipe, through which the water from the recevoir, having a suitable head or fall, is fed into the valve F; G is the partition which controlls the direction in which the water passes after it enters the valve F. When the partition is set, as seen in Fig. 2, the water passes from the valve chamber F into the port D, and through the said part to the cylinder A to the left of the piston, forcing it to the right. The water which had previously forced the piston B to the left escapes through the port E into the exhaust pipe I. When the piston has arrived nearly to the end of the stroke, the cam J, Fig. 5, begins to reverse the valve, and when the piston has gone quite to the end of its stroke the partition G is then in the middle of the ports E and D, and as the water from both ends of the cylinder can escape at the exact instant at which the change in the motion of the piston takes place, the feed pipe, cylinder, and connections are relieved from the danger of any shock. The time during which the water can thus escape is so short that a slow motion imparts sufficient force to the engine to carry it past the centres, and there is no greater liability to stop on the centre than in the ordinary steam engine. The cam J, as to its form, consists of two concentric portions situated opposite each other, each of which is equal to one-third of a circle, and two curved portions having the outline of an ogee which connect these circular portions. These curved portions serve to give motion to the valve, while the circular portions provide for holding it perfectly still through two-thirds of the revolution of the shaft K, thereby preventing the chattering of the valve when it should be at rest. The cam J and connections are clearly shewn in Figs. 4 and 5, in which L is the yoke on the rod M. N, N, are friction rollers; O is the intermediate arm or lever for adjusting the amount of motion to be given to the arm P of the valve; this is done by moving the pin Q up or down. The valve F consists of two circular heads S, S, with a partition G supported between them; this partition G is set below or to one side of the centre, and the ports D and E open into the valve chamber in a corresponding position to give room on the opposite side of the interior surface of the valve chamber for a bearing for the chambers R, R, which may be cast in one piece with the partition G and

heads S, S, of the valve F. At their junction with the interior surface of the valve chamber they form a water-tight joint, and the interior *c* communicates through suitable openings with the outside of the valve chamber, so that the interior *c* of the said chamber R is entirely relieved from pressure, and consequently the pressure exerted by the water on the concave surfaces of the said chambers R, R, which are inside the valve chamber tends to counteract the pressure in the opposite, or nearly opposite, direction on the partition G, and thus reduce the friction of the partition G on the valve seat. To provide against leakage by the wearing of the valve in its seat or chamber it may be made tapering, so that the said valve may be set further in as it wears, thus keeping it tight.

Having thus described this Invention, as communicated to me, I claim,—

First, the combination of the chambers R, R, with the partition G in a rotary valve for a water engine, substantially as herein set forth.

Second, the combination of the ports D and E, and the partition G, constructed as described with the cam J for operating the valve, substantially as herein-before described.

In witness whereof, I, the said Edward Thomas Hughes, have hereunto set my hand and seal, this Sixth day of March, A.D. 1867.

E. T. HUGHES. (L.S.)

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Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1867.

A. D. 1866. Sep. 8. Nº 2306.
HUGHES' Provisional Specification.

FIG. 1.

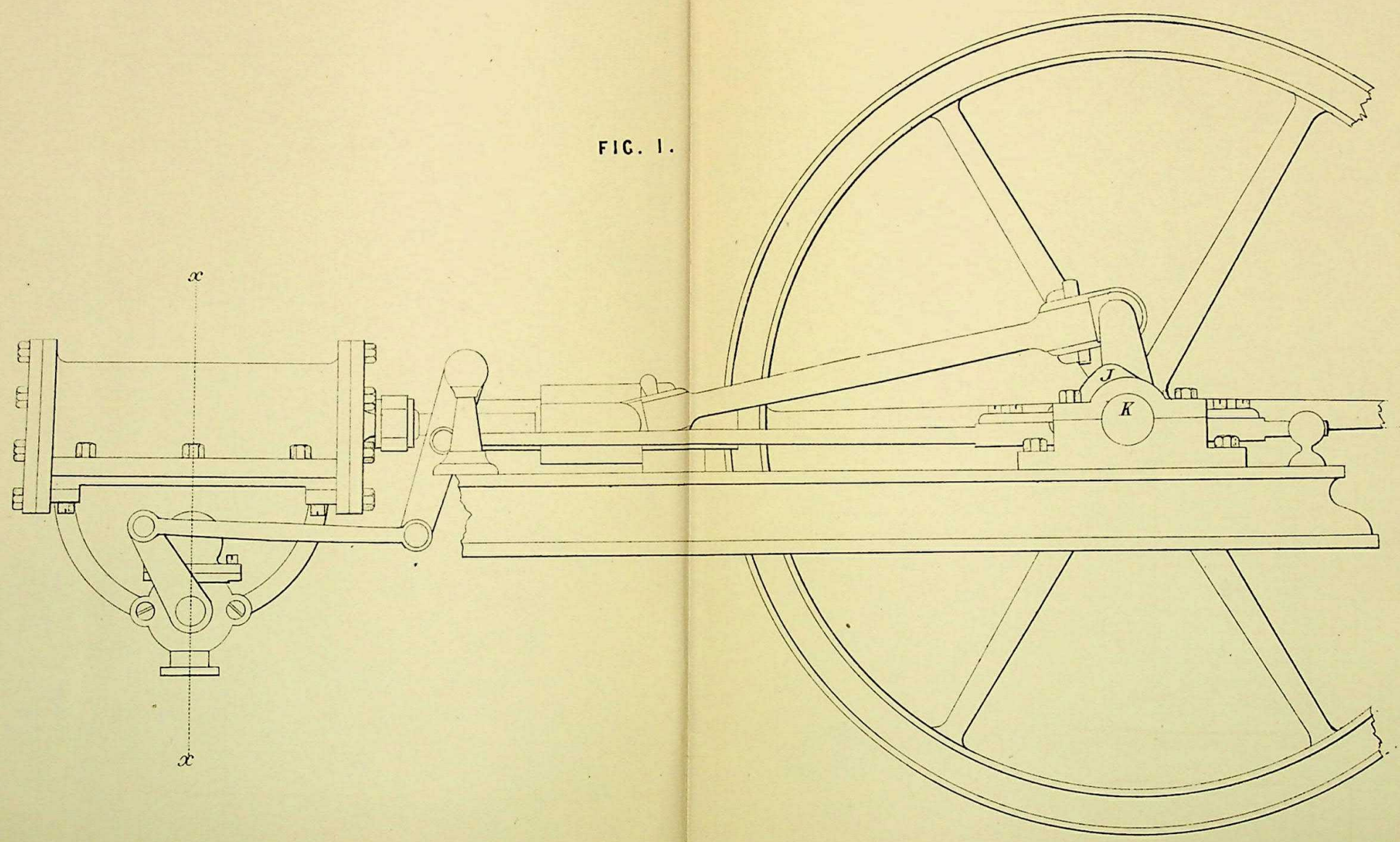


FIG. 2.

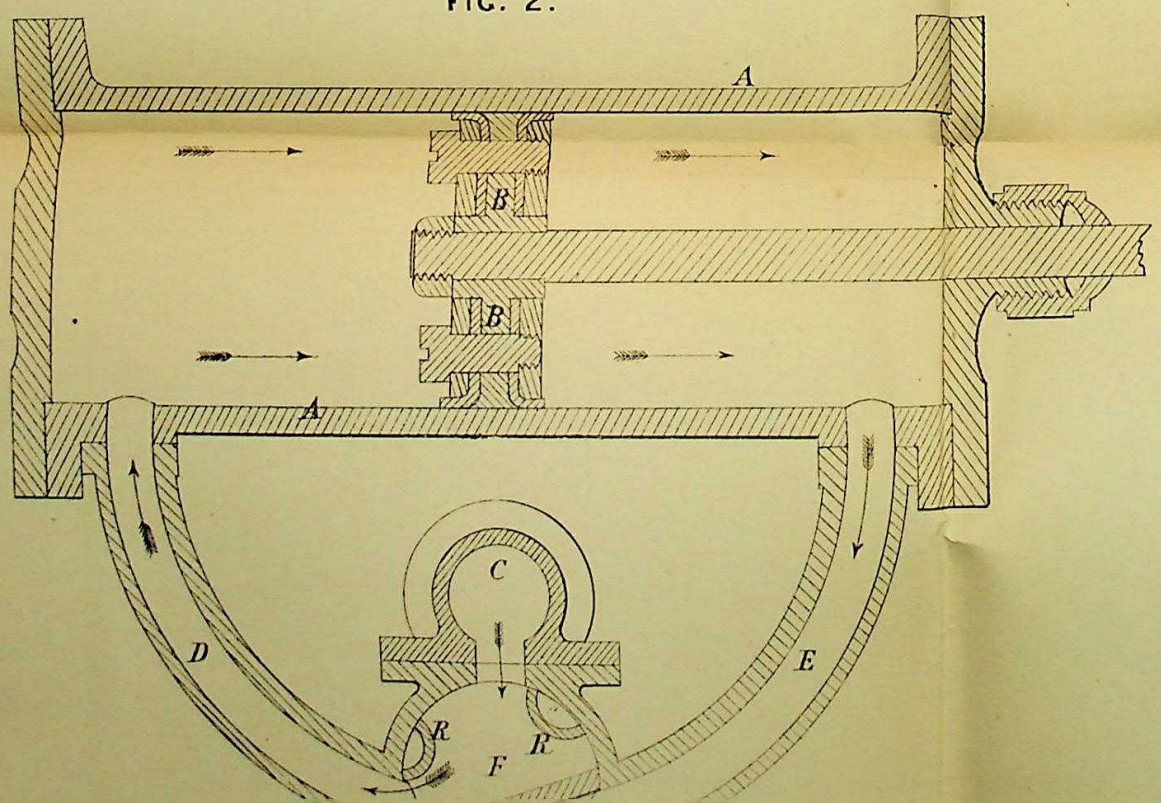
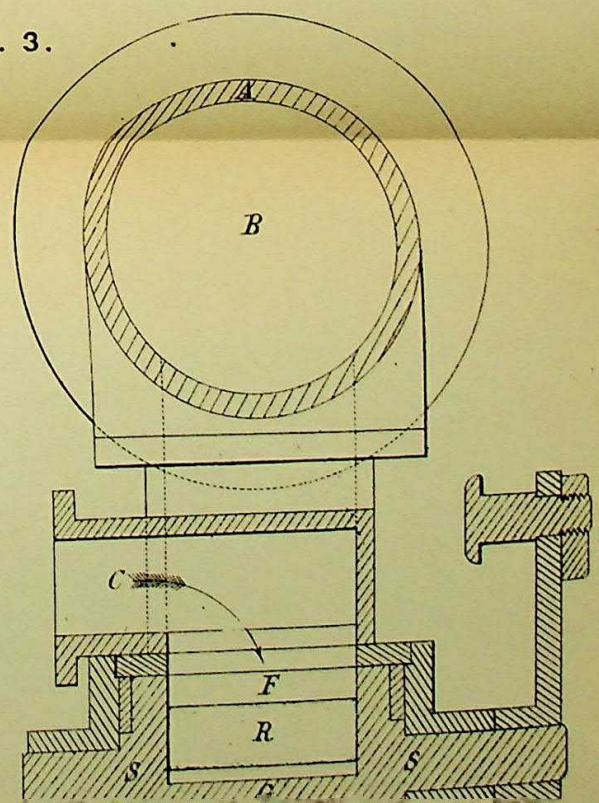


FIG. 3.



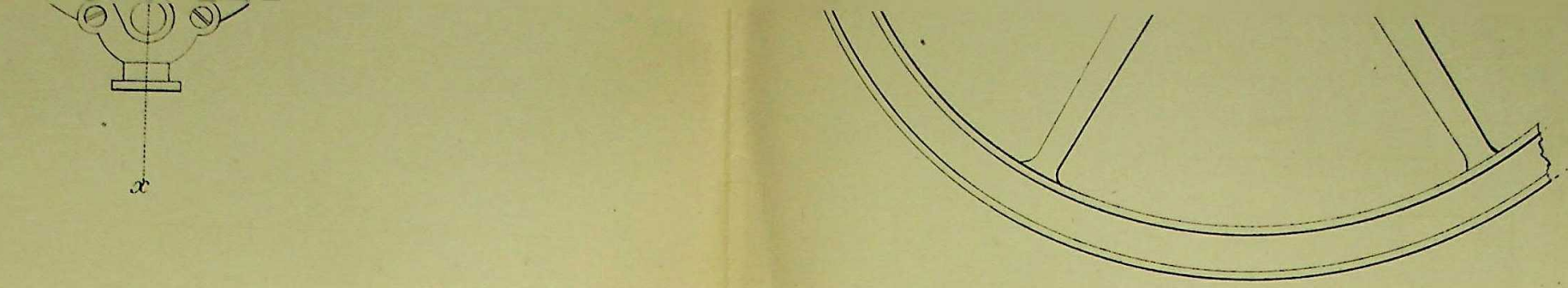
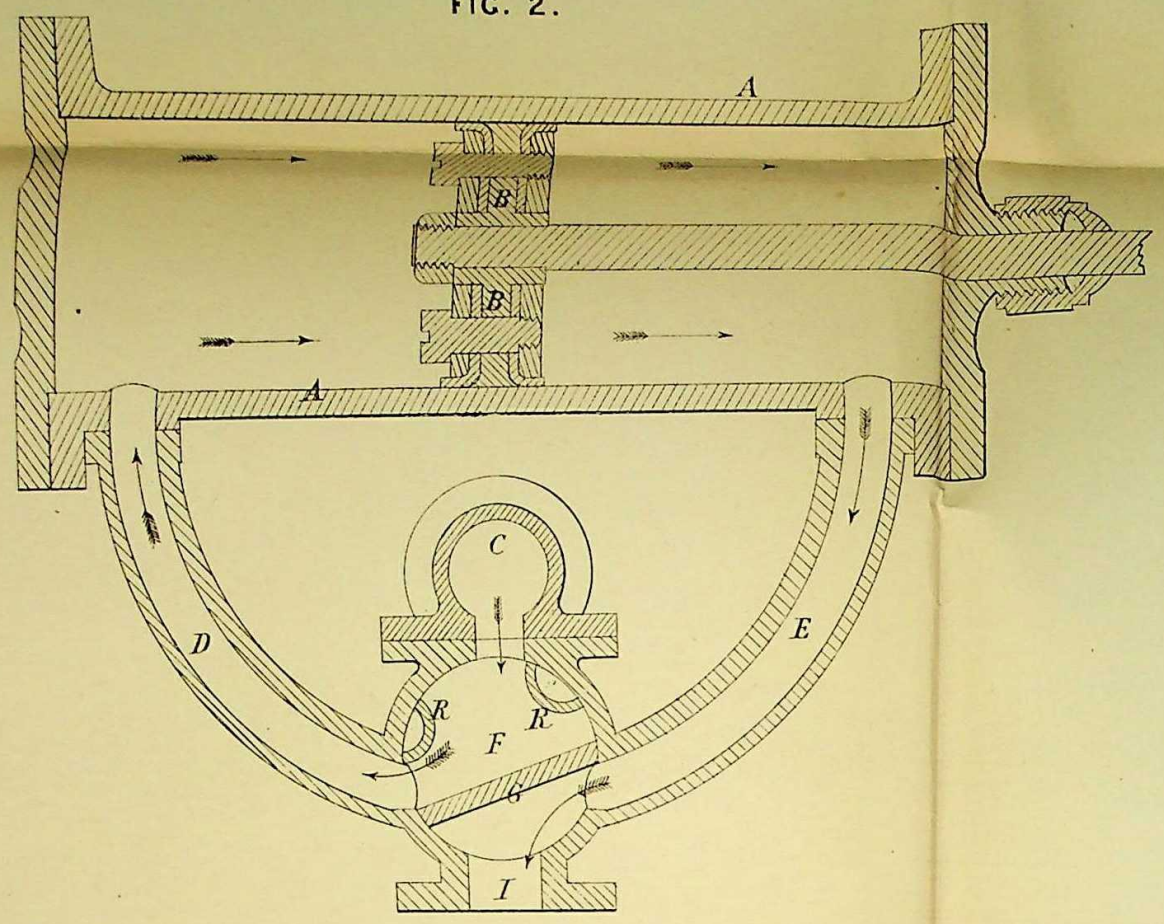


FIG. 2.



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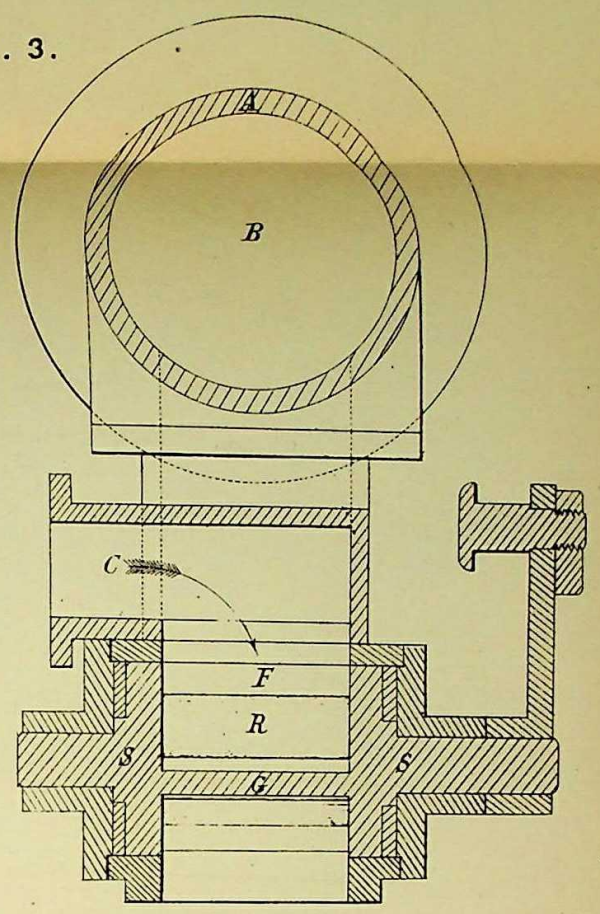


FIG. 4.

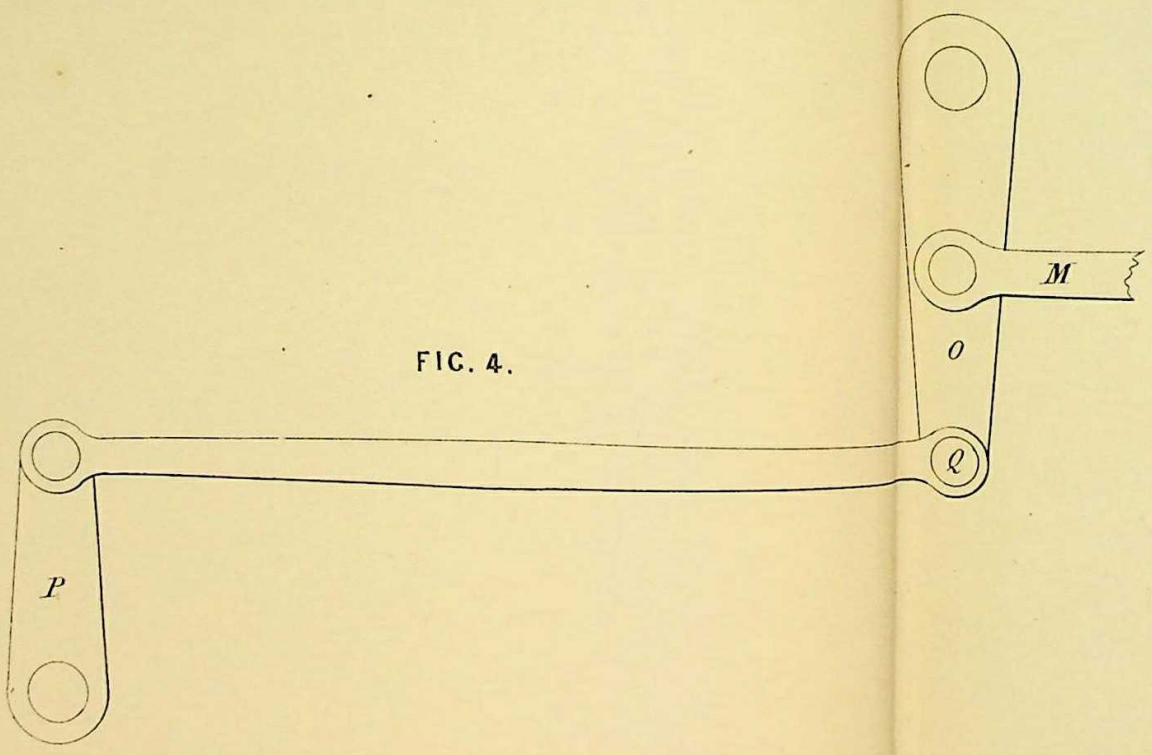
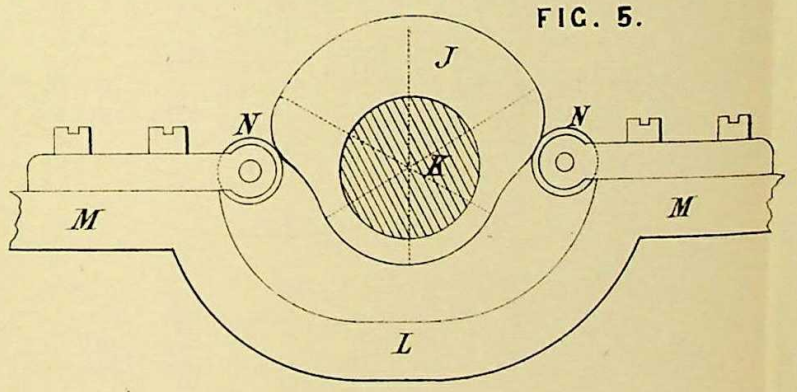


FIG. 5.



The drawing left with Provisional Specification is partly colored.

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HUGHES' SPECIFICATION.

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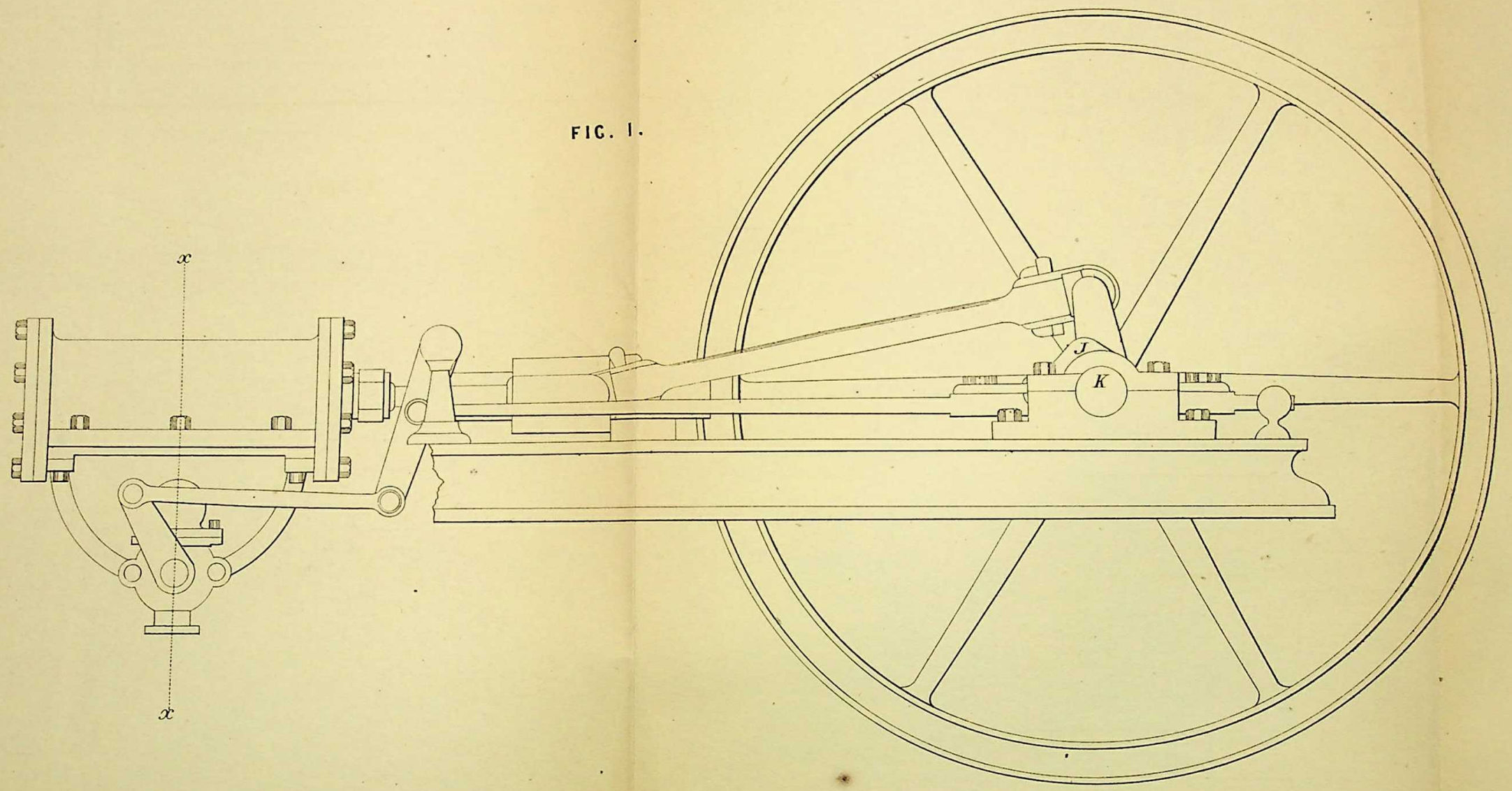

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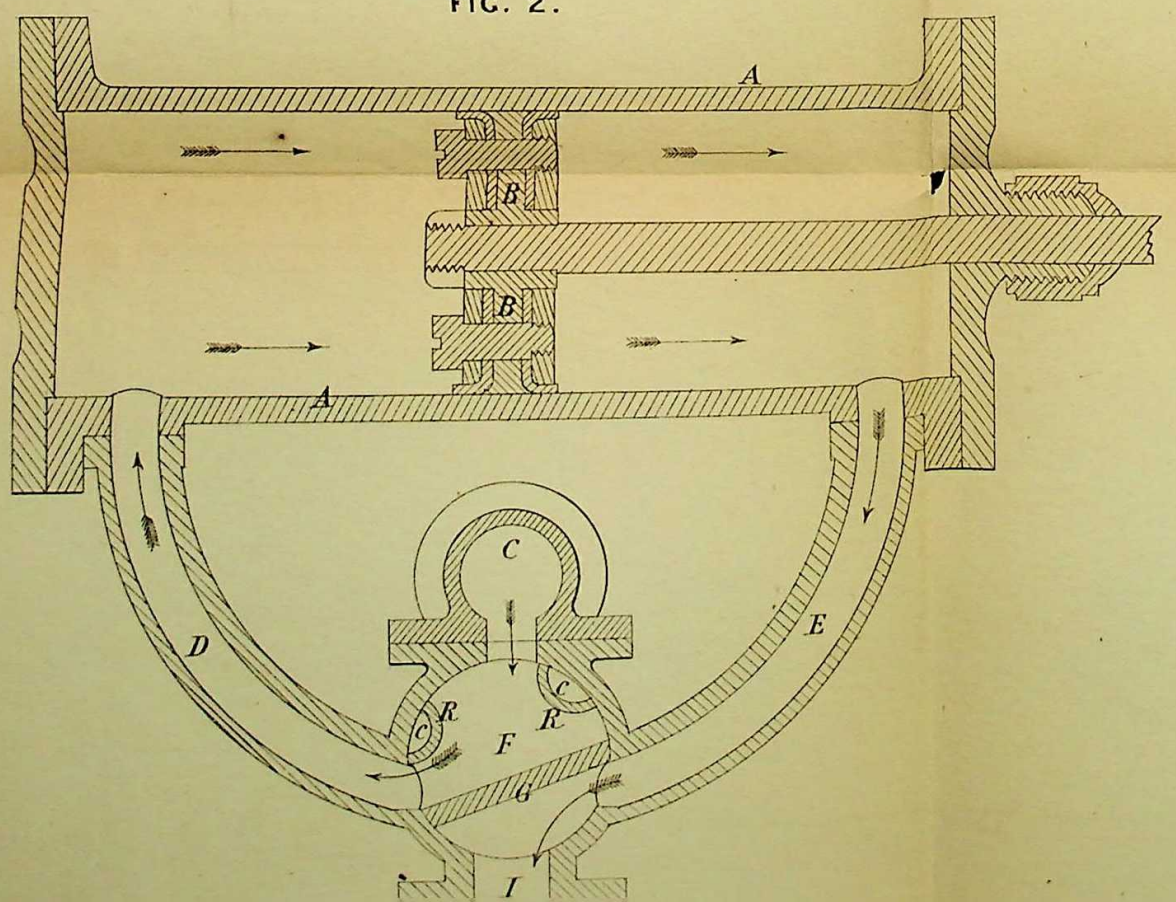

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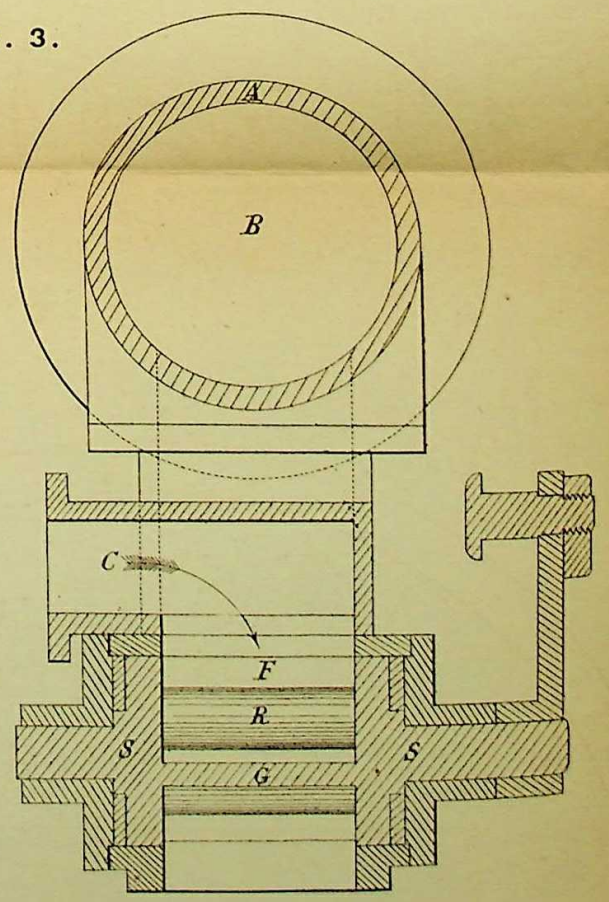

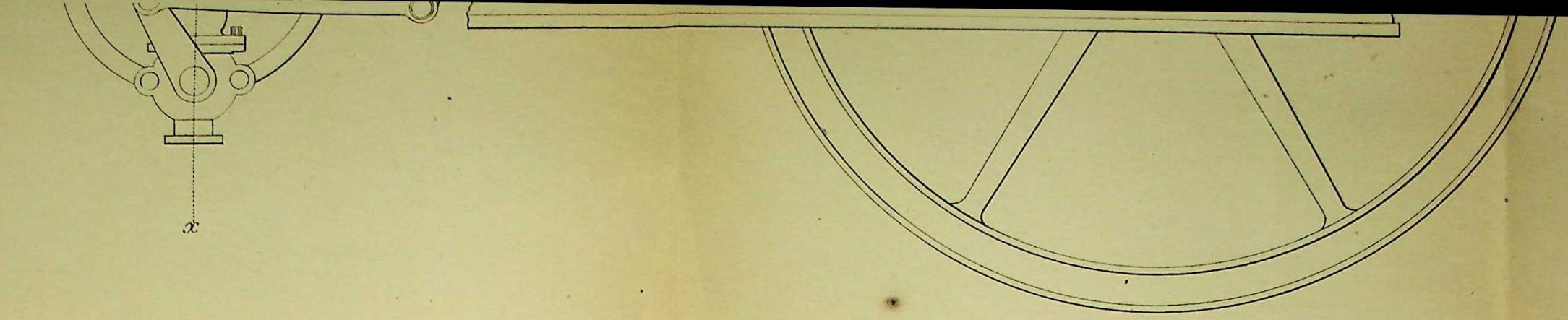

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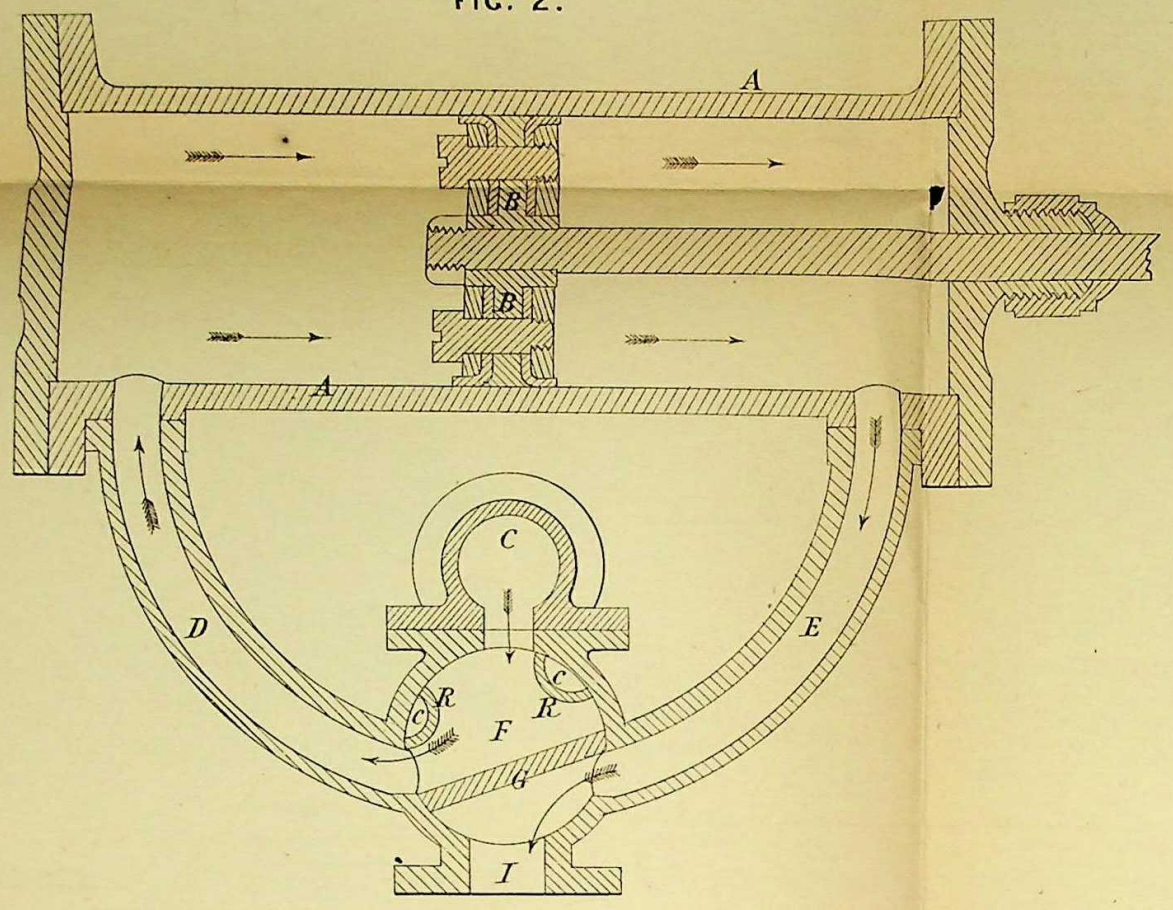

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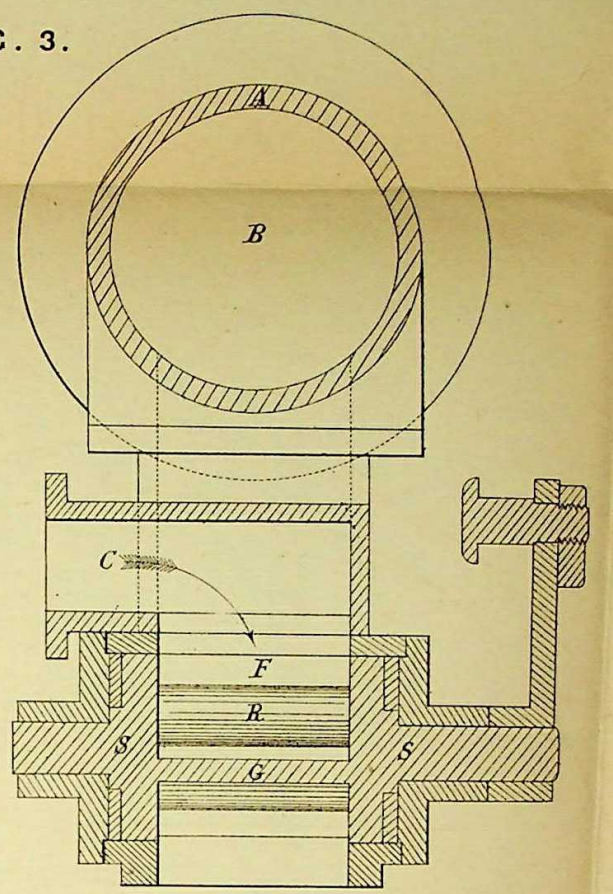


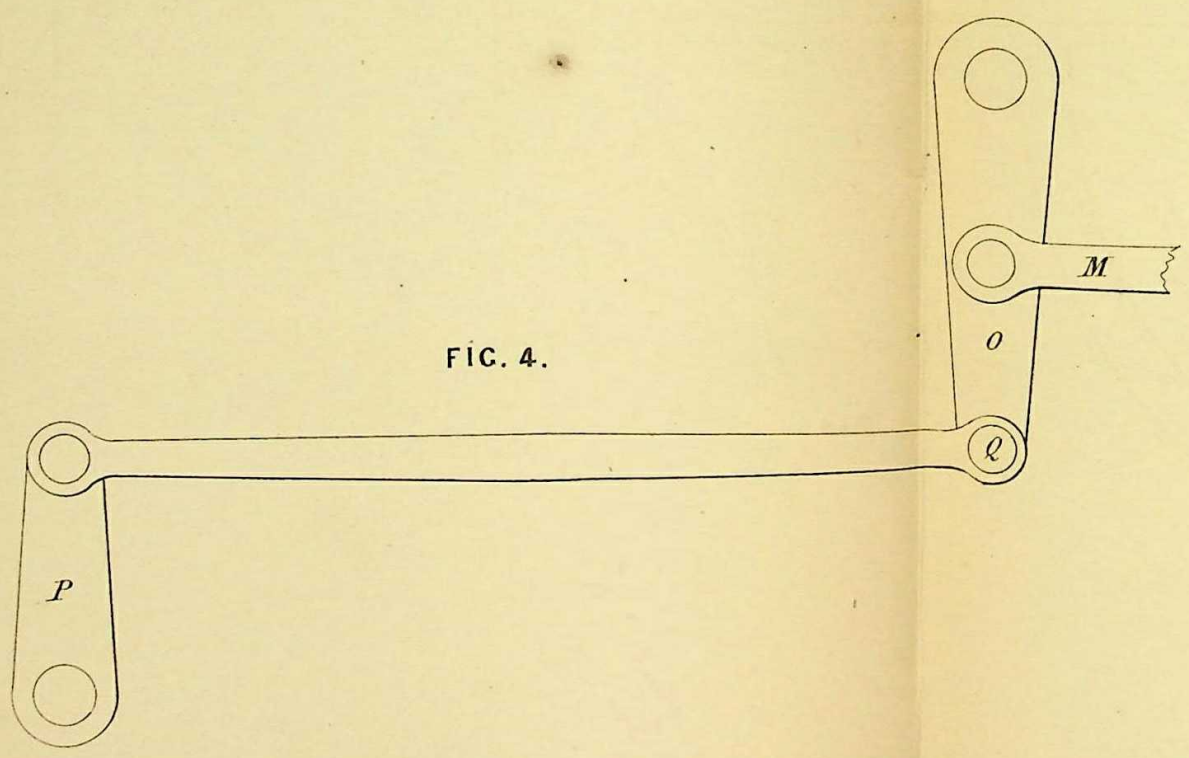
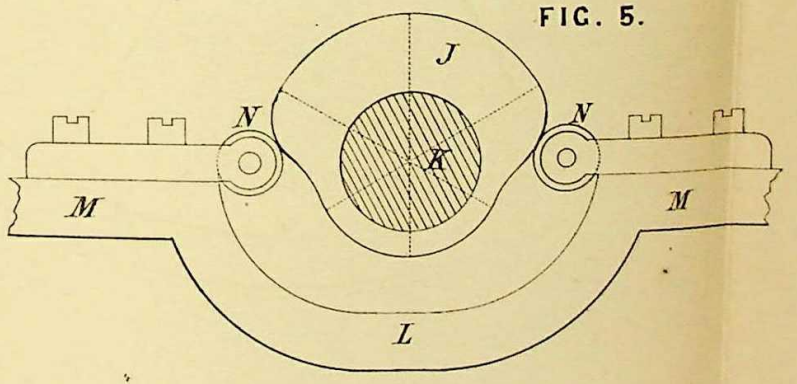


FIG. 4.

FIG. 5.



The filed drawing is not colored.

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